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<p>(54) Title: DETERGENT COMPOSITION</p> <p>(57) Abstract</p> <p>A detergent composition which gives a softening benefit in the wash. The detergent composition contains at least one detergent active material, a fabric softening clay which is a bentonite clay and at least 1 wt % of the total formulation, of a soluble potassium salt, expressed as K₂O.</p>		

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- 1 -

DETERGENT COMPOSITION

The present invention relates to detergent compositions for washing and softening fabrics, comprising at least one
5 detergent active material and a fabric softening bentonite clay. The invention also relates to a process for producing the clay.

With some fabrics, especially of natural origin, repeated
10 washing can lead to fabric harshness, giving the fabrics an unpleasant feel. For some years, fabric conditioning products have been available, intended inter alia for alleviating this fabric harshness by softening the fabrics in
15 a post-washing step, for example in the rinse step of a fabric laundering process. There have also been provided single detergent compositions which are capable of both washing and softening the fabrics to overcome the inconvenience of using separate products.

20 According to British Patent GB 1 400 898 (Procter & Gamble/STORM) one such single detergent and softening composition is provided by including in the detergent composition a smectite clay containing material having a cation exchange capacity of at least 50 meq/100g, together
25 with a detergent active material.

GB 2 138 037 discloses a fabric softening detergent in which
30 a clay may be activated by inserting a monovalent metal into the clay structure. Sodium and potassium are given as examples of the monovalent ion.

While some success has been obtained with the use of such
35 clay materials, softening performance still does not generally match that obtained by the use of separate products and there is therefore scope for improving performance.

- 2 -

Clays of interest in the present invention are swelling types, which expand and delaminate in liquid media. These clays belong to the group of phyllosilicates and are three-layer sheet type crystalline materials. The sheet structures are composed of three layer arrangements of tetrahedral silica, octahedral alumina, and tetrahedral silica. The central layer may be dioctahedral or trioctahedral and the three layer sheet structures are separated by an interlamellar space.

Clays are defined as crystalline and amorphous hydrated silicates of Al, Mg Li and Fe. They comprise fine colloidal particles. The following key features distinguish the different varieties:

- a) chemical composition;
- b) the degree of isomorphic substitution (replacement of one framework ion with another of similar size, usually of different valence).

Point b) offers the opportunity for a permanent charge on the lattice which must be balanced by cations present in close proximity. These features can be clearly illustrated with reference to talc and hectorite (magnesium silicates) and pyrophyllite and montmorillonite (aluminosilicates); details of which are given in table 1:

TABLE 1

CLAY	ISOMORPHIC SUBSTITUTION	FORMULA
TALC	NO	$Mg_3 Si_4 O_{10} (OH)_2$
HECTORITE	YES	$(M^+)_{\alpha} (Mg)_{6-\alpha} (Li)_{\alpha} Si_8 O_{20} (OH)_4$
PYROPHYLLITE	NO	$Al_2 Si_4 O_{10} (OH)_2$
MONTMORILLONITE	YES	$(M^+)_{\alpha} (Al)_{4-\alpha} (Mg)_{\alpha} Si_8 O_{20} (OH)_4$

- 3 -

In the table M+ refers to the charge balancing cations introduced as a result of the isomorphic substitution. The degree of isomorphic substitution determines the magnitude of the layer charge, a crucial factor in the swelling of clays.

The layer structure has many variants in nature. For example the central octahedral layer may have the two aluminium ions (Al^{3+}) (dioctahedral) replaced by three magnesium ions (Mg^{2+}) (trioctahedral) or the octahedral layer may be partially occupied by the substitution of one Al^{3+} for one Mg^{2+} (dioctahedral) or one Mg^{2+} for one Li^+ (trioctahedral) resulting in a residual surplus of negative charge in the structure. A residual surplus of negative charge can also arise when silicon ions (Si^{4+}) in the tetrahedral layer are replaced by aluminium ions (Al^{3+}).

The surplus of negative charge requires the presence of balancing cations which are located in the interlamellar space between the sheet structures. A measure of the degree of the surplus charge is given by the number of exchangeable cations, as reflected by the cation exchange capacity CEC of the pure mineral. The CEC of a mineral is directly related to the lattice charge deficiency of that mineral.

This can be further explained by general representation of clays useful in the present invention which fall into the formulae:

$(\text{Si}_{4-y} \text{Al}_y) (\text{M}^{\text{III}}_a \text{N}^{\text{II}}_b) \text{O}_{10} (\text{OH})_2 \text{X}^{n+}_{(y+b)/n}$ (dioctahedral clays)

or:

$(\text{Si}_{4-y} \text{Al}_y) (\text{N}^{\text{II}}_a \text{L}^{\text{I}}_b) \text{O}_{10} (\text{OH})_2 \text{X}^{n+}_{(y+b)/n}$ (trioctahedral clays)

- 4 -

Where X^{n+} is a balancing exchangeable cation which can be univalent or divalent

$y + b$ is the lattice charge deficiency of the mineral per half unit cell

5 M^{III} is a trivalent metal ion e.g. Al^{3+} , Fe^{3+} , Cr^{3+}

N^{II} is a divalent metal ion e.g. Mg^{2+} , Fe^{2+} , Ni^{2+} , Zn^{2+}

L^I is a univalent metal ion e.g. Li^+

y is zero or a positive number less than four

a and b are separately or together zero or positive numbers.

10

CEC measurements indirectly determine the number of $X^{n+}_{y+b/n}$ present in 100g and quote these as meq.

15

The value of $y+b$ (the lattice charge deficiency) in gram equivalents per half unit cell is therefore directly related to CEC.

20

Swelling is the process in which solvent molecules penetrate the inter layer space between individual crystals, and occurs very readily in clays containing exchangeable cations such as hectorites and montmorillonites. The factors which most influence the swelling behaviour is aqueous suspension are:

25

- i) the origin of the layer charge - ie. whether the substitution is in the octahedral (Mg or Al) layer or the tetrahedral (Si) layer;
- ii) the magnitude of the layer charge; and
- iii) the identity of the inter layer cation.

30

Point i) is important because substitution in the tetrahedral layer creates a localised charge and in the octahedral layer a delocalised charge. The latter interacts only weakly with water molecules.

- 5 -

Clays used in through the wash fabric softening are generally montmorillonites. Although it has been shown that softening performance is a function of lattice charge, the detailed mechanism of the action of clays in fabric softening is not fully understood. Both delamination (swelling) behaviour, and electrostatic forces between the clay particles and the fabric substrate are thought to govern the overall process, and both are influenced by layer charge.

Montmorillonites occur in nature with a range of layer charges, and optimum softening is observed with a limited number of clays of poor colour which have layer charges at the lower end of the range. The lattice charge of clays can however be modified by chemical treatment. Controlled incorporation of Li cations in the crystal lattice (by ion exchange/calcination) is described in EP 0 401 047 (Unilever) and leads to an improvement in the performance of the clay through charge reduction.

Layer charge reduction of montmorillonite requires neutralisation of a delocalised negative charge. This is thought to be achieved when Li cations penetrate the crystal lattice upon dehydration. They are thought to move into octahedral vacancies in the aluminous region of the montmorillonite lattice. This process requires an expensive calcination step to achieve the dehydration of the Li cation before penetration into the lattice can take place.

Soil scientists recognise close association of certain cations with clay surfaces and call it cation fixation. Potassium is the most closely studied ion. Its ionic diameter closely matches the diameter of the ring of six oxygen atoms characteristic of clay crystal surfaces. Good coordination of potassium by the clay surface can therefore be reasonably expected.

- 6 -

EP 0 401 047 describes a fabric softening clay mineral which is a dioctahedral 2:1 layer phyllosilicate comprising at least 100 micrograms of lithium per gram of clay mineral. This specification mentions that K⁺ can be a balancing exchangeable cation in a clay.

It is known to exchange K⁺ into clays in the petroleum engineering art. For example KCl or KOH have been used as electrolytes in drilling fluids to stabilise montmorillonite or other smectite clays during boring operations. Potassium is also a natural constituent of some natural bentonite clays at a level of up to 1% as K₂O.

Potassium will also have been used with bentonite clay by virtue of it being present at a low level in sodium salts when prepared commercially. The level of potassium would have been less than 1%, as K₂O, of the total clay in this case.

The number and availability of naturally occurring clays is fairly limited. Such naturally occurring clays may be of unsuitable colour for inclusion in a detergent composition or may give rise to fabric colour dulling once deposited thereon. It is therefore desirable that a boosting of softening performance be achieved for lower performance naturally occurring clays of good colour, so that the range of clays that can be used for fabric softening is extended.

We have found that such a performance boost can be achieved if a bentonite clay is treated with potassium. We have also found that this treatment can be carried out either before the clay is incorporated in the detergent composition or by ion exchange during the washing process.

- 7 -

Accordingly the present invention claims a detergent composition for washing and softening fabrics comprising at least one detergent active material, a fabric softening clay which is a bentonite clay and at least 1%, of the total formulation of a soluble potassium salt, expressed as K_2O .

The present invention also claims a detergent composition for washing and softening fabrics comprising at least one detergent active material, and a potassium ion exchanged bentonite clay whereby the level of potassium in the clay is more than 1.5% expressed as K_2O .

Such potassium treated clays have the advantage that they can be selected from a wide range of good colour parent clays. Detergent compositions containing modified clays have the advantage that colour dulling associated with off colour clays may be avoided and improved softening can be obtained.

One aspect of the process of the present invention comprises the preparation of partially potassium exchanged clays. They may be prepared by mixing dry sodium clay with a solution containing potassium ions, typically KCl solution to form a stiff dough. The dough is then subjected to high shear in a sigma blade mixer and then dried and crushed.

They may also be prepared by spraying sodium clay with a potassium solution in a rotating drum, for example an agglomerating apparatus.

Alternatively the clays may be prepared by:

- (i) mixing dilute aqueous suspensions of fully potassium and fully sodium exchanged clays in appropriate ratios; or

- 8 -

(ii) carrying out ion exchange of the clay in a mixed sodium/potassium medium.

5 Preferably, the mixtures of sodium and potassium clay minerals are in the ratio range of 8:2 to 2:8 parts by weight. If ion exchange takes place in solution before the detergent is formulated then it is desirable to dry the clay.

10 It is preferred if the ratio of sodium to potassium in the exchanged clay is less than 2:1, preferably less than 1:1.

15 Surprisingly we have found that as an alternative to ion exchanging potassium into the clay before it is included in a detergent formulation, it is also efficacious to formulate with non-ion exchanged or partially ion exchanged clay and provide a source of potassium ions to exchange during the wash. Advantageously the source of potassium ions is provided by the partial or total replacement of a sodium salt normally present in the detergent composition, by the
20 corresponding potassium salt. It is preferable if the corresponding potassium salt is present in a level greater than 2.5 wt% of the total composition, more preferably a level greater than 5 wt%, most preferably at a level greater than 7.5 wt%.

25 To give a source of potassium ions, potassium carbonate may be included in the formulation in place of the usual sodium carbonate, a second example of this technique is the replacement of sodium citrate by potassium citrate.

30 It is also advantageous to include a potassium base in the composition, for example potassium hydroxide, which may supply potassium ions and also neutralise any acid, for example citric acid, in the composition.

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- 9 -

Clay mineral containing materials useful in the present invention include dioctahedral and trioctahedral three layer smectite clays, ideally of the calcium and/or sodium montmorillonite type. For example PRASSA clay from Greece, GELWHITE from Texas USA, Willemse from South Africa and VOLCLAY BC from Wyoming. The effectiveness of a clay containing material as a fabric softener will depend partly on the level of clay mineral in the material.

The detergent compositions according to the present invention may take various physical forms and may contain a variety of additional ingredients.

An essential ingredient is a detergent active material. This may be selected from anionic, nonionic, amphoteric, zwitterionic and cationic materials, with a special preference for synthetic anionic surfactants, with or without nonionic surfactants.

Particularly preferred are mixtures of anionic and nonionic detergent active materials such as a mixture of an alkali metal salt of an alkyl benzene sulphonate together with an alkoxylated alcohol. The level of detergent active material or materials in the composition may be from 2% to 50%, most preferably from 5% to 30% by weight.

In some formulations it is preferable to have at least 25 wt% anionic detergent active material in the composition.

The preferred detergent compounds which can be used are synthetic anionic and nonionic compounds. The former are usually water-soluble alkali metal salts of organic sulphates and sulphonates having alkyl radicals containing from about 8 to about 22 carbon atoms, the term alkyl being used to include the alkyl portion of higher acyl radicals. Examples

- 10 -

of suitable synthetic anionic detergent compounds are sodium and potassium alkyl sulphates, especially those obtained by sulphating higher (C_8-C_{18}) alcohols produced for example from tallow or coconut oil; sodium and potassium alkyl (C_9-C_{20}) benzene sulphonates, particularly sodium linear secondary alkyl ($C_{10}-C_{15}$) benzene sulphonates; sodium alkyl glyceryl ether sulphates, especially those ethers of the higher alcohols derived from tallow or coconut oil and synthetic alcohols derived from petroleum; sodium coconut oil fatty monoglyceride sulphates and sulphonates; sodium and potassium salts of sulphuric acid esters of higher (C_8-C_{18}) fatty alcohol-alkylene oxides, particularly ethylene oxide, reaction products; the reaction products of fatty acids such as coconut fatty acids esterified with isethionic acid and neutralised with sodium hydroxide; sodium and potassium salts of fatty acid amides of methyl taurine; alkane monosulphonates such as those derived by reacting alpha-olefins (C_8-C_{20}) with sodium bisulphite and those derived from reacting paraffins with SO_2 and Cl_2 and then hydrolysing with a base to produce a random sulphonate; and olefin sulphonates, which term is used to describe the material made by reacting olefins, particularly $C_{10}-C_{20}$ alpha-olefins, with SO_3 and then neutralising and hydrolysing the reaction product. The preferred anionic detergent compounds are sodium ($C_{11}-C_{15}$) alkyl benzene sulphonates and sodium ($C_{16}-C_{18}$) alkyl sulphates.

Suitable nonionic detergent compounds which may be used include in particular the reaction products of compounds having a hydrophobic group and a reactive hydrogen atom, for example aliphatic alcohols, acids, amide or alkyl phenols with alkylene oxides, especially ethylene oxide either alone or with propylene oxide. Specific nonionic detergent compounds are alkyl (C_6-C_{22}) phenols-ethylene oxide condensates, generally up to 25 EO, i.e. up to 25 units of

- 11 -

ethylene oxide per molecule, the condensation products of aliphatic (C_8-C_{18}) primary or secondary linear or branched alcohols with ethylene oxide, generally up to 40 EO, and products made by condensation of ethylene oxide with the reaction products of propylene oxide and ethylenediamine. Other so-called nonionic detergent compounds include long chain tertiary amine oxides, long chain tertiary phosphine oxides and dialkyl sulphoxides.

Mixtures of detergent compounds, for example mixed anionic or mixed anionic and nonionic compounds may be used in the detergent compositions, particularly in the latter case to provide controlled low sudsing properties. This is beneficial for compositions intended for use in suds-intolerant automatic washing machines.

Amounts of amphoteric or zwitterionic detergent compounds can also be used in the compositions of the invention but this is not normally desired due to their relatively high cost. If any amphoteric or zwitterionic detergent compounds are used it is generally in small amounts in compositions based on the much more commonly used synthetic anionic and/or nonionic detergent compounds.

A detergency builder may also be present. This may be any material capable of reducing the level of free calcium ions in the wash liquor and will preferably provide the composition with other beneficial properties such as the generation of an alkaline pH, the suspension of soil removed from the fabric and the suspension of the fabric softening clay material. The level of the detergency builder may be from 10% to 70% by weight, most preferably from 25% to 50% by weight.

- 12 -

Examples of detergency builders include precipitating builders such as the alkali metal carbonates (with or without seed crystals such as calcite), bicarbonates, ortho phosphates, sequestering builders such as the alkali metal tripolyphosphates or nitrilotriacetates, or ion-exchange builders such as the amorphous alkalimetal aluminosilicates or the zeolites.

The clay material can be added in various physical forms. It may, for example, be spray-dried with other components of the formulation or it may be added separately. In the latter case the clay may be ground to a suitable size, say 5 to 2000 microns, or may be in the form of granulated fine particles optionally containing a binder such as an inorganic salt or a surfactant.

The level of the fabric softening clay material in the composition should be sufficient to provide a softening benefit, such as from 1.5% to 35% by weight, most preferably from 4% to 15% by weight, calculated on the basis of the clay mineral per se.

In addition to the detergent active material, the detergency builder and the clay containing material, the compositions according to the invention optionally contain other ingredients.

Apart from the components already mentioned, a detergent composition of the invention can contain any of the conventional additives in the amounts in which such additives are normally employed in fabric washing detergent compositions. Examples of these additives include additional fabric softening agents such as a cationic fabric softening agent or a fatty amine. Further examples of these additives include the lather boosters such as alkanolamides,

- 13 -

particularly the monoethanolamides derived from palm kernel fatty acids and coconut fatty acids, lather depressants, oxygen-releasing bleaching agents such as sodium perborate and sodium percarbonate, peracid bleach precursors, chlorine-releasing bleaching agents such as trichlorisocyanuric acid, inorganic salts such as sodium sulphate, other fillers such as kaolin, and, usually present in very minor amounts, fluorescent agents, perfumes, other enzymes such as proteases lipases and amylases, germicides and colorants.

The invention will now be described with reference to the following non-limiting examples.

Example 1 - Preparation of Ion Exchanged Clay

Potassium ion exchanged clay and ammonium ion exchanged clay for comparative purposes were prepared by the following method. The montmorillonite used was Prassa clay ex Colin Stewart Minerals. Potassium acetate (anhydrous ex Sigma) was used without additional drying. Ammonium, sodium and potassium salts were all ex BDH GPR and solutions of the required concentration were made up using Millipore water.

150 ml of 0.1M solution of KCl or NH_4Cl were added to a suspension of montmorillonite (approximately 20g in 500ml). The mixture was stirred overnight and then centrifuged and washed repeatedly with water, until only traces of the anion could be detected in the washings. The pastes obtained were dried at 60°C, ground finely and stored in glass screw-top jars.

Example 2 - Alternative preparative method

Montmorillonite (20g) was weighed into polythene pots containing 200 ml of a mixture of Na and K (or NH_4) chloride

- 14 -

solutions (1.0M). The relative proportions of Na and K were varied and the total ionic strength maintained. The pots were shaken thoroughly, and stored for one week with occasional further mixing during that time. The mixtures were centrifuged and washed as in example 1, then dried at approximately 100°C, ground finely, using a mortar and pestle and stored as in example 1.

Example 3 - Washing Experiments

All washing experiments were carried out in tergotometers using the conditions given in Table 2:

TABLE 2

Temperature	40°C
Wash Time	15 min
Rinse	2 x 2 min.
Volume of Wash Liquor	1 litre
Monitors	50g Terry Towelling
Liquor:Cloth	20:1
Water	26°FH

All monitors were desized

Evaluation of softening by the different clays was carried out subjectively by paired comparison, using a panel of trained assessors.

Montmorillonite clays exchanged with K and NH₄ cations in accordance with example 1 were added at 0.5 g/L to a phosphate built washing powder and tested against a reference containing no clay and a control containing a Na-montmorillonite material.

- 15 -

The performance of all clays tested is superior to the zero clay reference, so they all show a softening benefit - see Table 3. Within the series of clays however, the NH_4^+ exchanged material shows an equivalent performance to the reference. The K exchanged clay shows enhanced softening over all the compositions.

TABLE 3

Clay	Relative Softening
None	0
NaMontmorillonite	83
K ⁺ Exchange	100
NH_4^+ Exchange	86

A comparison of the softening results for potassium and ammonium exchanged clay shows that the use of an ammonium ion, although of similar ionic radius to potassium, does not lead to any improvement in clay softening.

Example 4 - Effect of Varying K/Na Ratio

A series of clay samples of varying K/Na content prepared using the method of example 2 were tested; once again in comparison to a zero clay control. The results of using them at 0.5 g/L in a phosphate formulation are shown in Table 4. All clays show improved softening relative to no clay.

TABLE 4

Clay (Na/K)	Relative Softening (%)
None	0
200/0	46
140/60	78
60/140	100

The phosphate formulation used for examples 3 and 4 was:

- 16 -

	Parts (wt)
Linear alkyl sulphonate (Dobane 113)	9.0
Nonionic (Synperonic A7)	1.0
Sodium tripolyphosphate	21.5
Alkaline Silicate	5.5
Water	10.3
Sodium Carboxymethyl Cellulose	2.7
	50.0 pts
Dosage 2.5 g/L	

Similar results were obtained with a zeolite base.

Potassium fixation by montmorillonite can therefore be used to enhance the performance of clays for through the wash softening. Whilst not wishing to be bound by theory this enhancement is believed to be a result of an effective reduction of the clay lattice charge. Even though the K exchanged clay may need to be dried, overall the process is much more convenient than processes involving an expensive calcination step.

Example 5

For this example a non-ion exchanged clay was used and the effect of ion exchanging with Na and K electrolytes in the wash was investigated using the conditions of example 3, except that the experiments were carried out using 0.5 g/L clay in demin water, to eliminate any builder or active effects. Comparison of clay softening from Na and K solutions of equivalent ionic strength ($10^{-2}m$) shows significantly better performance for the potassium system - Table 5. Mixtures of sodium and potassium show similar effects.

- 17 -

TABLE 5

	Relative Softening (%)	Ash (% w/w)
Reference - No Clay	0	0.05
Clay + 10 ⁻² M NaCl (1)	68	0.17
Clay + 10 ⁻² M KCl (1)	100	0.20
Clay + 10 ⁻² M NaCl (2)	60	0.18
Clay + 10 ⁻² M KCl (2)	96	0.24

(1) Salt solution added at beginning of wash cycle.

(2) Salt solution added 10 minutes into wash cycle.

The clay in all cases was Na Montmorillonite (ex CSM), added at 0.5 g/l.

Equivalent results to those found for example 4 were obtained by adding the sodium or potassium salts in the middle of the wash cycle, indicating that the effect is operative even after initial interaction of clay with fabric has occurred.

Table 4 also records the results of washing experiments which indicate that the enhanced softening seen in the presence of potassium ions is as a result of enhanced clay deposition.

Example 6

Example 5 was repeated using simulated wash liquors.

Softening was monitored from sodium carbonate containing solutions of LAS:nonionic (0.83g/l approx. 9:1 LAS:NI).

Experiments using this system were also carried out in the presence and absence of zeolite (4A - 1.8g/l hydrated).

The results (Table 6) show that potassium enhances the softening performance of clay both in the presence of actives and zeolite.

- 18 -

TABLE 6

Formulation	Relative Softening
Base only	0
Base plus Clay	66
Base plus Clay plus 10^{-2} M KCl	100
Base/Clay/ 10^{-2} KCl/Zeolite	98

Base composition is: 0.75 g/L LAS
0.08 g/L NI
1.20 g/L Na_2CO_3

Example 7

This example shows the effect of added potassium on the softening performance of clay in a detergent system containing a linear alkyl sulphonate anionic and a nonionic detergent active in various ratios. Table 7 shows that the performance enhancement due to use of potassium treated clay is greatest in the 100% anionic formulation. The effect was demonstrated by measurement of clay deposition levels (ash). Mixtures of soap and nonionic actives show analogous behaviour.

TABLE 7

% Nonionic	% Ash (clay deposition)	
	NaCl	KCl
0	0.8	1.3
25	0.85	1.05
50	0.8	0.95
75	0.6	0.9

Example 8

Detergency of zeolite built systems in the presence and absence of both added potassium and clay was studied using

- 19 -

builder sensitive cloths. The change in reflectance at a wavelength of 460nm for two different sample cloths (ΔR_{460}) was used as the measure of detergency. Reflectance measurements were made on the cloths before and after washing using an Ultrascan spectrophotometer.

Comparison of results of equivalent formulations, based on either sodium or potassium chloride shows no difference in detergency - see Table 8:

TABLE 8

Salt (*)	ΔR_{460}	
	Cloth 1	Cloth 2
NaCl	19.7	10.2
KCl	20.9	11.2

Wash Liquor Composition: 0.75 g/L LAS
0.08 g/L NI (3 EO)
1.2 g/L Na_2CO_3
1.8 g/L Zeolite 4A
 10^{-2} M Salt (*)

Example 9

In the above examples 5 to 8 potassium was added in the form of its chloride. Potassium could be added in the form of carbonate, replacing sodium carbonate as a source of alkalinity.

Experiments were carried out investigating the softening performance of clay in the presence of sodium and potassium carbonate. The results (see Table 9) clearly show enhanced softening from potassium carbonates, both in the presence and absence of zeolite. Enhanced clay softening appears possible by the replacement of sodium carbonate by potassium carbonate.

- 20 -

TABLE 9

PRODUCT (*)	Relative Softening (%)
$1.1 \times 10^{-2} \text{m Na}_2\text{CO}_3$	0
+ 0.5 g/l clay	56
$1.1 \times 10^{-2} \text{m K}_2\text{CO}_3$ + 0.5 g/l clay	100
$1.1 \times 10^{-2} \text{m K}_2\text{CO}_3$ + 0.5 g/l clay + 1.8g zeolite	97

(*) All contain additionally 0.75 g/l LAS and 0.08 g/l Synperonic A7 ex ICI.

Using either potassium exchanged clays, or especially the addition of potassium salts to clay containing wash liquors to obtain "high performance" clay softening is the simplest and most cost effective method of improving clay performance.

CLAIMS

1. A detergent composition for washing and softening fabrics comprising at least one detergent active material, a fabric softening clay which is a bentonite clay and at least 1 wt%, of the total formulation, of a soluble potassium salt, expressed as K_2O .
2. A detergent composition according to claim 1 in which the potassium salt is potassium carbonate.
3. A detergent composition according to claim 1 in which the potassium salt is potassium citrate.
4. A detergent composition according to any preceding claim in which the bentonite is selected from montmorillonites and hectorites.
5. A detergent composition according to claim 4 in which the clay is a montmorillonite.
6. Use of a potassium modified bentonite clay as a fabric softener.
7. A detergent composition for washing and softening fabrics comprising at least one detergent active material, and an potassium ion exchanged bentonite clay whereby the level of potassium in the clay is more than 1.5% expressed as K_2O .
8. A process for washing and softening fabrics comprising the steps of
 - a) adding a detergent powder including a mixture of bentonite clay, detergent active material and at

- 22 -

least 1 wt%, of the total formulation, of a soluble potassium salt to water to form a wash liquor.

b) washing the fabric in the liquor; and

c) rinsing the liquor from the fabric by use of more water.

9. A process for washing and softening fabrics comprising the steps of

a) adding a detergent liquid including a mixture of bentonite clay, detergent active material and at least 1 wt%, of the total formulation, of a soluble potassium salt to water to form a wash liquor.

b) washing the fabric in the liquor; and

c) rinsing the liquor from the fabric by use of more water.

INTERNATIONAL SEARCH REPORT

Intern. Appl. No.

PCT/EP 94/00469

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 C1103/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 5 C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,4 436 637 (RAMACHANDRAN ET AL.) 13 March 1984	1,3-7
A	see column 3, line 15 - column 4, line 29; claim 1; example 3	9
X	FR,A,2 537 595 (COLGATE - PALMOLIVE CO.) 15 June 1984	1,3-7
A	see page 4, line 26 - page 7, line 9; claim 1	9
X	DE,A,39 43 019 (HENKEL) 4 July 1991	1,2,4,5,8
	see column 1, line 1 - column 2, line 47; claims 1,2; examples	
X	EP,A,0 328 183 (THE PROCTER & GAMBLE CO.) 16 August 1989	1,4-7
A	see abstract; claims 1-8	9
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

3 June 1994

Date of mailing of the international search report

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	see page 5, line 29 - page 6, line 34 see page 11, line 1 - page 12, line 26; claim 1	8
X	GB,A,1 400 898 (THE PROCTER & GAMBLE CO.) 23 July 1975 cited in the application see page 8, line 20 - page 10, line 42; claims 1-11	1,2,4,5
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